MISSOURI DEPARTMENT OF NATURAL RESOURCES

Possible Effects of COVID-19 Stay-At-Home Order on Kansas City Area Air Quality

October 19, 2020

The Missouri Department of Natural Resources is continuing to evaluate the possible effects on air quality of the COVID-19 stay-at-home order, issued for Kansas City beginning on March 24, 2020 and extending through May 4, 2020. We are also evaluating the possible effects on air quality of changes in activity following the end of the stay-at-home order.

Since the COVID-19 event is having an impact on emission from many sources across the country and the world, the following analysis is based on limited observational data and the department is not drawing conclusions as a result of this analysis.

One effect of the order was a reduction in motor vehicle traffic, because fewer people were commuting to work and fewer people were driving on the weekend. Motor vehicle exhaust is a significant source of nitric oxide (NO), which is oxidized in the atmosphere to nitrogen dioxide (NO_2). Therefore, a reduction in traffic would be expected to lead to a reduction in the NO_2 concentration in the air, especially near major highways.

The near-roadway NO_2 monitoring network was established to measure the population exposure to peak 1-hour NO_2 concentrations. Peak 1-hour concentrations of NO_2 result from many sources that emit nitric oxide in addition to motor vehicles, including but not limited, to industrial boilers, furnaces, factories, power plants, fires, and certain home heating appliances. Therefore, these near-roadway sites were established within 50 meters (or 164 feet) of road segments with the highest traffic volumes in areas with populations of one million people or more to measure worst-case peak 1-hour NO_2 concentrations from all these sources in areas with the high population density.

It is important to recognize that ambient air NO_2 monitors alone are not able to directly identify the source of the NO_2 pollution they measure. Source apportionment of the monitored ambient NO_2 is a complex analysis involving many factors and is beyond the scope of this observational analysis.

NO_2, among other pollutants, is a precursor to ground level ozone. Unlike NO_2, ozone is not directly emitted by sources, but a pollutant formed in the atmosphere by very complex chemical reactions involving oxides of nitrogen and volatile organic compounds in the presence of sunlight and other conducive weather conditions. Maximum ozone concentrations are typically monitored 10 to 30 miles down wind of precursor emission sources. The department intends to conduct more observational analysis of ozone concentrations during the period of the stay-at-home order, but weather conditions during March and April are generally not conducive to producing significant peak ozone concentrations from precursor pollutants.

The Department operates a near-road air monitoring site (called Blue Ridge I-70) on the east side of Kansas City adjacent to I-70 about two miles east of the I-435 interchange (Figure 1). The location of this site is shown on the map in Figure 2. This site is not in violation of the NO_2 national ambient air quality standard (NAAQS); see dnr.mo.gov/env/apcp/docs/nitrogendioxidemonitordata.pdf. However, data from this site still show the effect of vehicle traffic. We have evaluated NO_2 data from this site in the past: we calculated and graphed average NO_2 concentrations by time of day, and separately for weekdays, weekends and major holidays. The weekday averages clearly show higher concentrations during early morning and early evening, which are probably caused by increased commuter traffic at those times. The weekend averages do not show the same peaks, but do show an increase in the late evening.

To evaluate the effect of the stay-at-home order on air quality, we generated the graphs described above for the period of March 24 to May 4 for 2019 and 2020, for the remainder of May, and for June and July. Graphs of data from the Blue Ridge I-70 near-road site are shown on the following pages. The weekday graphs (Figures 3, 4, 5, and 6) still show morning and evening peaks, possibly caused in part by truck traffic, but the NO_2 concentrations measured in 2020 during the stay-at-home order and during the remainder of May are generally lower than those in 2019 for most of the day during the same periods. However, the June and July graphs of 2020 data were similar to those for the same periods in 2019.

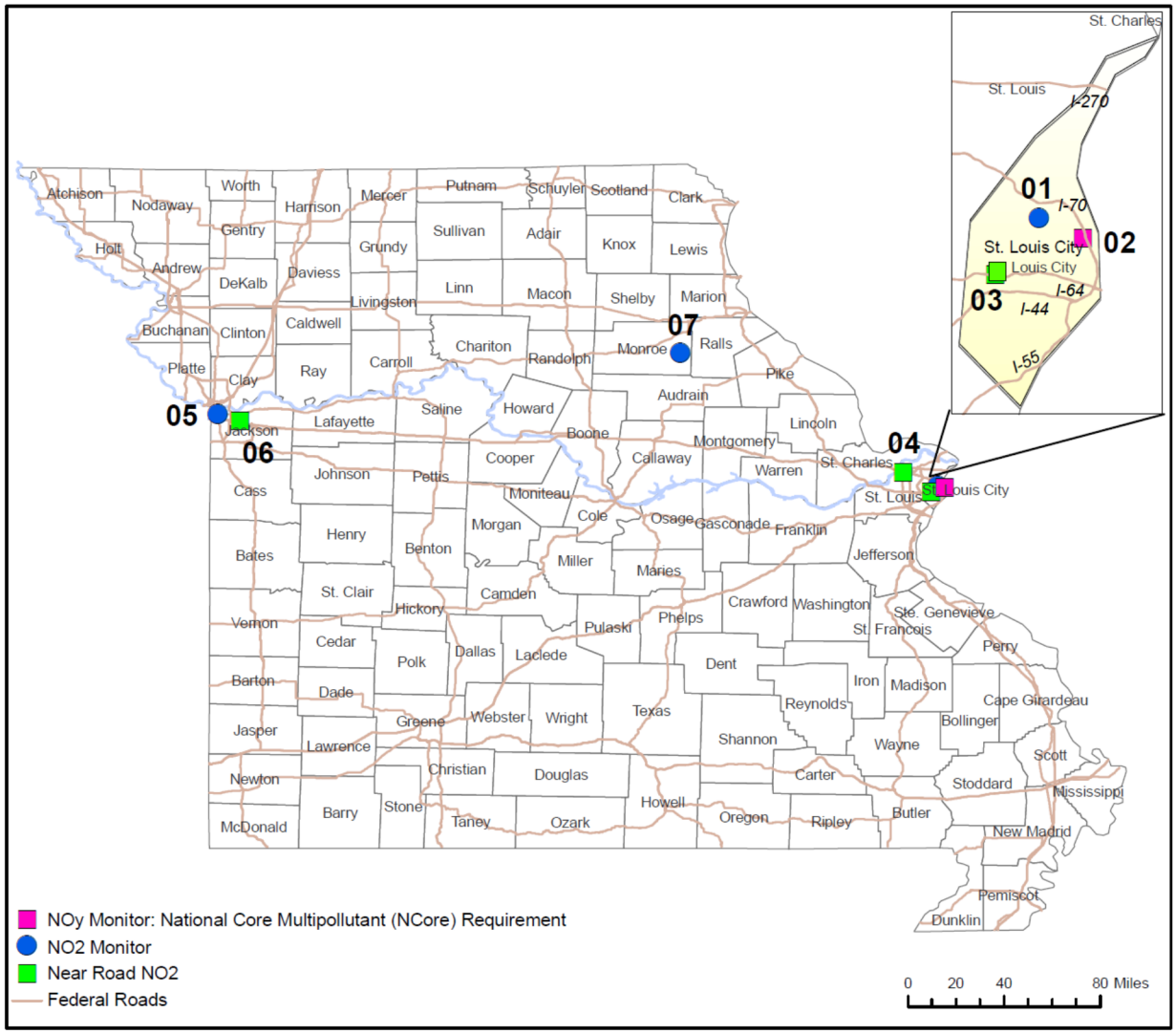
The weekend graphs (Figures 7, 8, 9, and 10) for March 24 to May 4 and for the remainder of May 2020 are similar to those for the same periods in 2919, but the evening peaks are much lower in the 2020 graphs than in the 2019 graphs. The June and July weekend graphs do not show as clear a difference between 2020 and 2019.

These results suggest that vehicle traffic may have been reduced during the stay-at-home order and during the remainder of May, especially on weekdays and weekend evenings, but that traffic may have gradually returned to normal levels during June and July, especially on weekdays.

For more information about nitrogen dioxide, see the following EPA website, which includes links to additional information on health effects, standards, implementation, etc. at epa.gov/no2-pollution.

Figure 1. Blue Ridge I-70 air monitoring site, Kansas City

Figure 2. Missouri Statewide Nitrogen Dioxide (NO2) Monitoring Network, 2020



St. Louis Area
- 01 Margaretta+
- 02 Blair Street**
- 03 Forest Park, I-64*
- 04 Rider Trail, I-70*

Kansas City Area
- 05 Troost
- 06 Blue Ridge, I-70*

Outstate Area
- 07 Mark Twain State Park***

*Near-Road sites
**National (NCore) multi-pollutant site
***Background site
+Discontinued Monitor

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Figure 3. Weekday Nitrogen Dioxide (NO_2) Concentration by Time of Day at Blue Ridge I-70 Kansas City Near-Road Site During Stay-at-Home Order, March 24-May 4, 2020 and Same Period in 2019 (prelim. data)

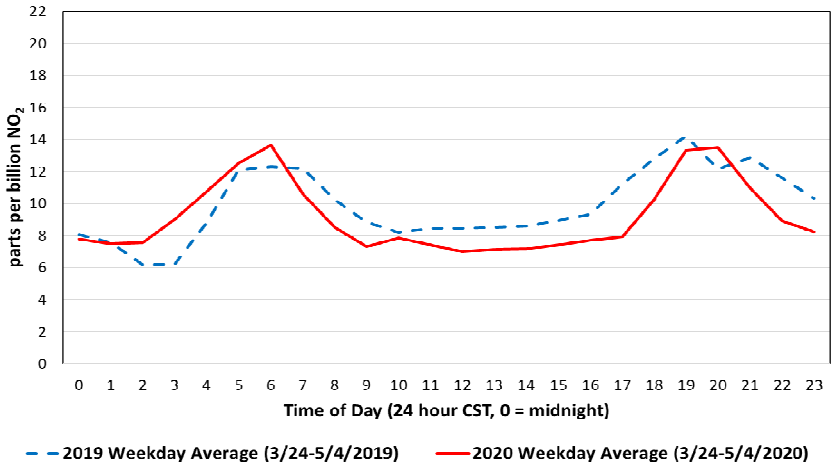

Figure 4. Weekday Nitrogen Dioxide (NO_2) Concentration by Time of Day at Blue Ridge I-70 Kansas City Near-Road Site During May 5-31, 2020 and Same Period in 2019 (preliminary data)

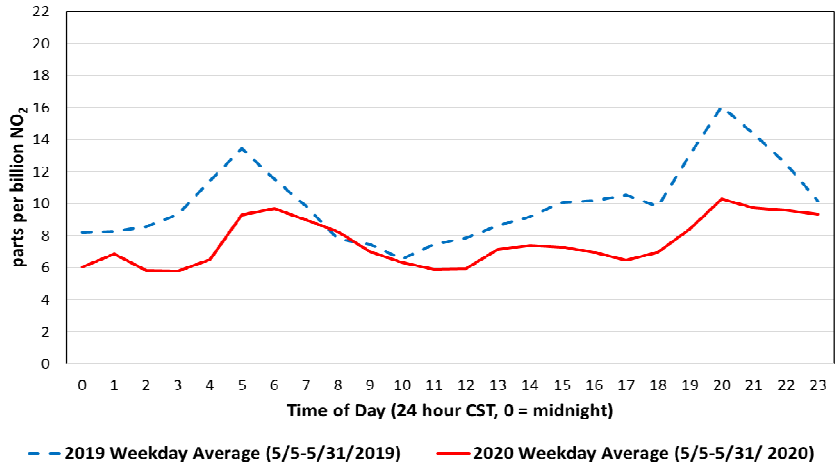

Figure 5. Weekday Nitrogen Dioxide (NO_2) Concentration by Time of Day at Blue Ridge I-70 Kansas City Near-Road Site During June 2020 and Same Period in 2019 (preliminary data)

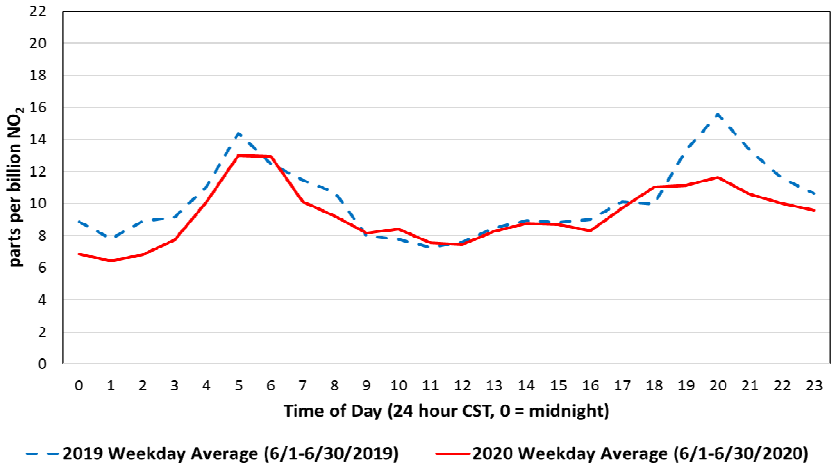

Figure 6. Weekday Nitrogen Dioxide (NO_2) Concentration by Time of Day at Blue Ridge I-70 Kansas City Near-Road Site During July 2020 and Same Period in 2019 (preliminary data)

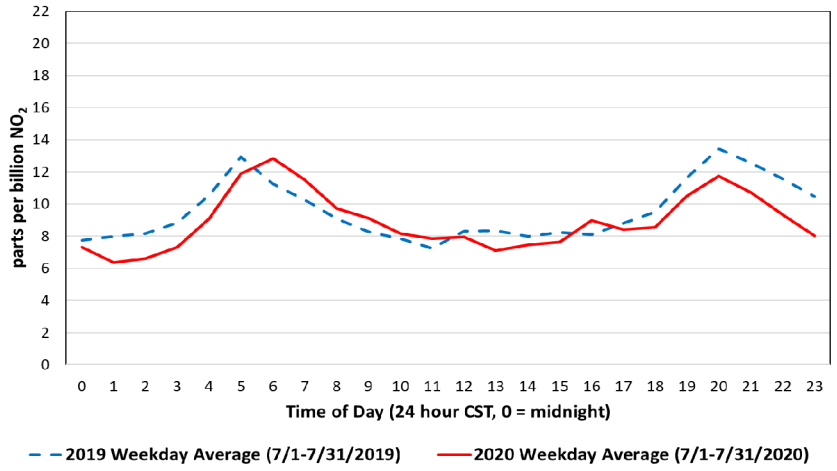

Figure 7. Weekend Nitrogen Dioxide (NO_2) Concentration by Time of Day at Blue Ridge I-70 Kansas City Near-Road Site During Stay-at-Home Order, March 24-May 4, 2020 and Same Period in 2019 (prelim. data)

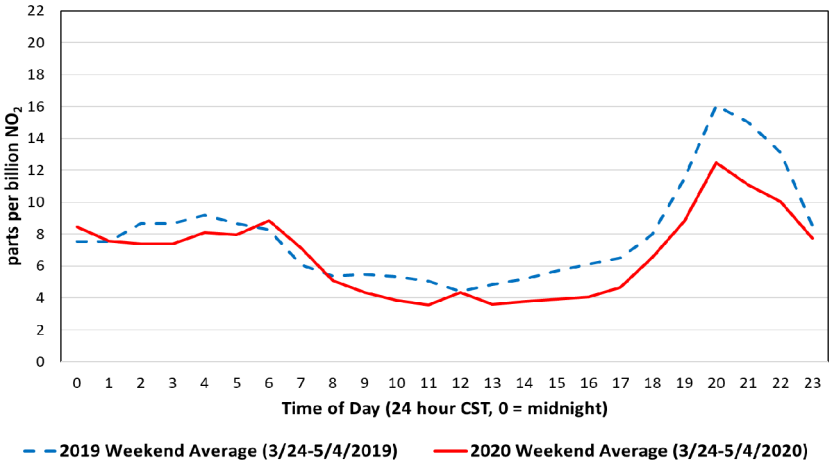

Figure 8. Weekend and Holiday Nitrogen Dioxide (NO_2) Concentration by Time of Day at Blue Ridge I-70 Kansas City Near-Road Site During May 5-31, 2020 and Same Period in 2019 (preliminary data)

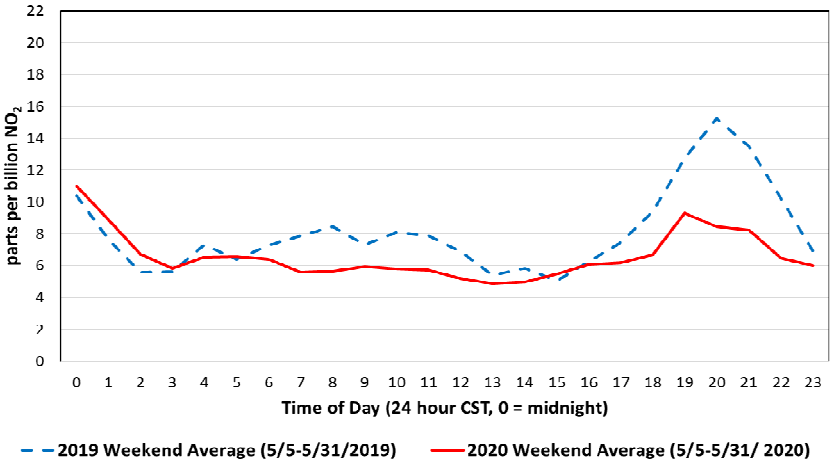

Figure 9. Weekend and Holiday Nitrogen Dioxide (NO_2) Concentration by Time of Day at Blue Ridge I-70 Kansas City Near-Road Site During June 2020 and Same Period in 2019 (preliminary data)

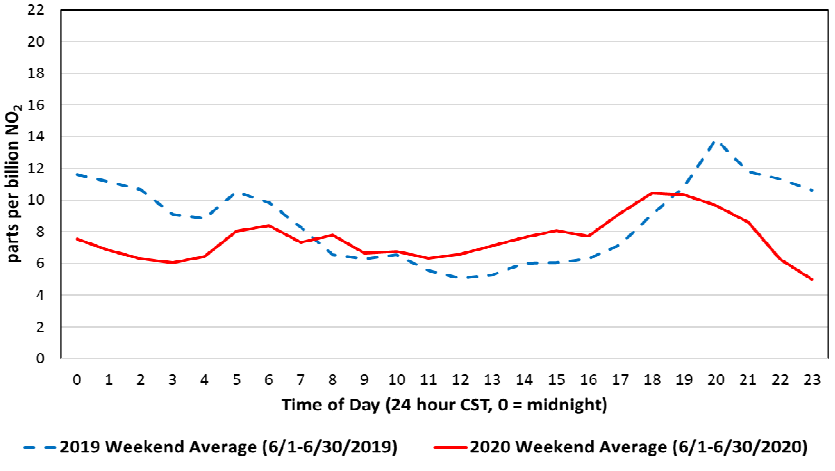

Figure 10. Weekend and Holiday Nitrogen Dioxide (NO_2) Concentration by Time of Day at Blue Ridge I-70 Kansas City Near-Road Site During July 2020 and Same Period in 2019 (preliminary data)